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NUTRIENT INTAKE OF THE REPATRIATED UNITED STATES ARMY, NAVY AND MARINE CORP PRISONERS-OF-WAR OF THE VIETNAM WAR

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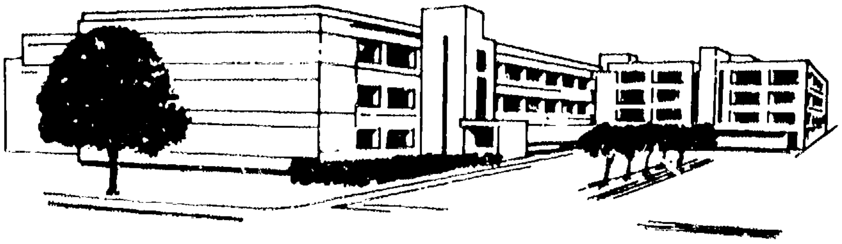

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Documentation of dietary and nutrient intake of the Army and Navy (including Marine) personnel from the United States, who were prisoners-of-war (POWs) in North and South Vietnam, has been limited to reports obtained from 241 repatriated men whose time in prison ranged from a few months to nine years. During Operation Homecoming (January-March 1973), the United States Army Medical Research and Nutrition Laboratory was requested to collect dietary and nutrient data (on forms designed by the Center of POW Studies). Military dietitians

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ABSTRACT

Documentation of dietary and nutrient intake of the Army and Navy (including Marine) personnel from the United States, who were prisoners-of-war (POWs) in North and South Vietnam, has been limited to reports obtained from 241 repatriated men whose time in prison ranged from a few months to nine years. During Operation Homecoming (January-March 1973), the United States Army Medical Research and Nutrition Laboratory was requested to collect dietary and nutrient data (on forms designed by the Center of POW Studies). Military dietitians obtained dietary histories from the men during the period of their medical evaluations and debriefings immediately after their return to CONUS. A total of 1190 diets, an average of 5 per man, were described. Daily nutrient intake was computed for each diet with the use of the laboratory's Nutrient Factor File. The nutrient intakes varied greatly; time in captivity, location, and health or punishment status were factors. Accurate histories could not be obtained because of communication problems (long recall periods, diversity of quantities and ingredients, limited time for interviews). Diets were divided by three components--a staple (i.e., rice, bread), soup, and a side dish (e.g., fish, meat, fruit, or vegetable which was served in later years). Data were not appropriate to submit for statistical analysis. Standard deviations from the mean reflect the great variations between prisoners and individually between time intervals. Nutrient intakes were low but not severe except for energy. POWs in the South had lower intakes and poorer diets than the prisoners in the North. Diets of many POWs improved after 1968 but many were deprived until shortly before repatriation. The data represent only the reports from those who survived the ordeal.

PREFACE

In preparation for Operation Homecoming several manuals, questionnaires and standard procedures were developed. In September 1972, I was given the opportunity to review and make suggestions about the Manual for Physicians developed for the physicians who would be involved in Operation Homecoming. The U.S. Army Medical Research and Nutrition Laboratory (USAMRNL) also suggested to the planners that personnel and resources at USAMRNL were available to obtain biological specimens and form an initial nutritional assessment on all repatriated prisoners of war at Clark Air Force Base when Operation Homecoming actually began. That suggestion was never implemented.

The Repatriated Prisoner of War Initial Medical Examination Forms developed by the Center for Prisoner of War Studies contained a series of questions to be completed by the dietitians at the receiving CONUS hospitals. These questions would provide: an evaluation of the quality and quantity of foods provided the prisoners during captivity; height and weight; weight change of the individuals during captivity; and a brief history of the energy expenditure.

Colonel Virginia Brice, Chief, Dietitian Section, Army Medical Specialist Corps, Office of the Surgeon General, Army, became concerned over the information available to the various military dietitians to permit evaluation of the adequacy of the Southeast Asian foods provided the prisoners in terms of the nutrient needs of the prisoners. During a visit to her office, in late January 1973, she inquired as to the feasibility of USAMRNL taking on the project of evaluating the dietary recall data in terms of nutritional adequacy for both the U.S. Army and U.S. Navy (to include U.S. Marine Corps). She was aware of our in-house data processing capabilities and the experience of several staff members gained through the conduct of nutrition studies in foreign countries. We agreed to take on the project.

The initial attempts by C.F. Consolazio, then Chief of the Bioenergetics Division and myself, rapidly identified a need to expand the data base of our Nutrient Factor File. Using food composition data derived from: the reports of nutrition surveys, conducted in Southeast Asia by the Interdepartmental Committee on Nutrition for National Defense; the Thailand Food Composition Tables; Department of Agriculture, Far Eastern Handbook Number 34; the Nutritive Values of Chinese Fruits and Vegetables, published by USDA in 1943; Food Composition Tables published for the Philippines by the Philippine Institute of Nutrition; Food Composition Tables International for Minerals and Vitamins, published by the Food and Agricultures Organization, 1954; materials provided by Dr. Jacque May, a world renouned nutritionist (now deceased), who had worked in Viet Nam in the 1920's and later; and material from other sources we were able to construct a Nutrient Factor File for Southeast Asian Foods, which was incorporated into the USAMRNL Nutrient Factor

File. A word of gratitude is in order for Dr. Conrado R. Pasqual, then head of the Philippines Nutrition Institute for his contributions.

About the same time, we were made aware of a young Lieutenant, who had completed the requirements for a Ph.D. in Nutritional Physiology, and was then undergoing orientation training for subsequent assignment to a Field Artillery unit at Ft. Sill. We were able to have this officer reassigned to USAMRNL. Lieutenant Terrel Hill came to us well-qualified to assist and eventually take over this project. As a missionary for the Church of the Latter Day Saints, he had spent three years in Taiwan and while working on his doctorate thesis at the University of Illinois he had spent 15 months studying the dietary habits of Indonesians in Eastern Java. Following his assignment Dr. Hill demonstrated his missionary zeal in his ceaseless efforts in processing and interpreting the data derived from the questionnaires obtained from the repatriates.

We wish to sincerely thank the dietitians of the U.S. Army and the U.S. Navy hospitals who so painstakingly provided us with the material that forms the basis of this report. They not only provided the initial input, but they cheerfully responded to the many telephonic inquiries from Lieutenant Hill that was necessary for clarification. We most sincerely wish to thank Colonel Brice for her continuing support during conduct of this project and the other projects addressed by the USAMRNL. Dr. Hill did depart the Letterman Army Institute of Research to return to school to obtain a Masters of Business Administration degree. His current address is: Dr. Terrel M. Hill, % UNICEF, Jalan Thamrin 14, Jakarta, Republic of Indonesia.

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Colonel, MC

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INTRODUCTION

Malnutrition and misery have always accompanied the confinement of war prisoners. Personal accounts of prisoners describe hunger and a desire for food as predominant in their thoughts (1). The chronicles of war show pictures of emaciated prisoners being liberated. Effects of malnutrition and undernutrition have been described and reported following the American Civil War (2,3), World Wars I and II (4-6), and Korea (7,8). The average captivity period of these wars was three or four years and prisoners were usually kept in permanent compounds and accounted for by name.

The war in Vietnam was much different than other wars involving the United States. Battlefronts were often undefined and the duration was longer. Some prisoners were held captive as long as nine years. Accurate accounting for missing or captured personnel has been impossible; inspection of camps or places where prisoners-of-war (POWs) were held was limited or not permitted at all. Sometimes the exact sites of where the men were held prisoners were not known. Some prisoners were also shuffled from place to place. Therefore, for the most part, we have had to rely on the information about the conditions and the description of the diet and food from accounts made by the repatriated POWs.

The Center of POW Studies (Naval Health Research Center, San Diego) has assembled volumes of data concerning the various aspects of captivity, including the medical aspects and the medical conditions of the Army and Navy (including Marine) repatriated POWs. The U.S. Army Medical Research and Nutrition Laboratory (USAMRNL), Denver, Colorado, (USAMRNL is now a component of the Letterman Army Institute of Research, Presidio of San Francisco, California) was requested to assemble and calculate the data on the nutrient intake, diets, and effects of the nutrient intake upon the repatriated men. This report is a compilation of the dietary and nutrient intake data USAMRNL was able to accumulate during Operation Homecoming. Since the data were not obtained completely objective, they can not be subjected to a statistical analysis. Our evaluation and conclusions of a general nature are stated empirically.

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1. Morgan, H.J. et al. JAMA 130:999, 1946.
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METHODS AND MATERIALS

Repatriation of U.S. Prisoners of war occurred January through March of 1973, under the direction of the Department of Defense (DOD) in Operation Homecoming (9). The medical aspects of this project were directed from the DOD level by the Assistant Secretary of Defense for Health and Environmental Affairs and The Surgeons General of the respective services. USAMRNL was requested by Colonel Virginia Brice, Chief, Dietician Section, Army Medical Specialist Corps, Office of The Surgeon General to accept the responsibility for evaluating the dietary data of the Army, Navy, and Marine Corps repatriates.

Data collection was effected by initially examining each prisoner at Clark Air Force Base in the Philippines and subsequently assigning him to a hospital near his home in the Continental United States (CONUS). A list of the Army and Navy hospitals and the numbers of repatriates assigned to each are shown in Table 1. At the CONUS medical facility, each patient was given a comprehensive battery of tests and examinations and required treatment or therapy initiated at Clark Air Force Base was continued and additional therapy was initiated as indicated. This initial medical evaluation was standardized through the use of instructions and forms provided by the Center for POW Studies (10).

Dietary intake data were collected through extensive interviews by military dietitians. The interviews were interspersed between other activities (e.g. debriefings, clinical tests, routine daily needs, visitors) during this initial hospitalization period at the CONUS facility. Instructions and data forms are found on pages 254 through 259 of the Initial Medical Evaluations Forms book (10). Some dietitians felt that inadequate time was allotted and that some interviews were hurried and difficult.

Dietary intake for the captivity period of each prisoner was divided into several diets based upon significant changes in food items or quantity served. A total of 1190 diets, which varied from one week to several years in duration, were described for the 241 men, an average of 5 per man. Dishes, bowls, cups and pictures were used to determine portion sizes. Unidentified foods were described by the repatriates for later identification.

Photocopies of the completed dietary histories of each repatriate were sent to the USAMRNL, Denver, CO. The food items of each record were identified and quantified and daily food intake was calculated utilizing computer programs and a Nutrient Factor File for Southeast Asian foods developed at USAMRNL.

9. Commanders Digest, March 1, 1973.
10. Repatriated Prisoner of War Initial Medical Evaluation Forms, 1972.

An attempt was made to standardize, for the purposes of this study, the weights or quantities of some foods frequently consumed. Table 2 shows the items and the standards for each. Some food items were recalled by their Vietnamese names requiring translation before identification could be effected. Many vegetables and other items were remembered as eaten "when in season." Therefore, a harvest and season calendar and glossary of Vietnamese plants and foods were used as reference materials (see Appendix C).

Daily nutrient intake was computed for each diet. The USAMRNL (now LAIR) Nutrient Factor File, a computer file formatted similar to USDA Handbook No 8 (11), was used in the computation. The USAMRNL file contains the nutrient composition of many food items from many sources throughout the world. The computer outputs describing each diet record and daily intake of nutrients were then compiled to express for each man an average daily nutrient intake for each month while in captivity. For example, a man captured in January 1967, would have 74 monthly records for use in summarization of nutrient intake. A duplicate copy of the records was sent to each interviewing dietician and a summary for each repatriate was forwarded to the Center for Prisoner-of-War Studies.

RESULTS AND DISCUSSION

The number of diets recorded in each month for January 1965 through March 1973, are shown in Figure 1. These values are very close to the number of men in captivity, as rarely did a man have more than one diet during a one-month period. The most dramatic increases in prisoner numbers occurred during the years 1967-1968, and 1972.

The nutrient intakes of the prisoners varied greatly among the prisoners and individually. They were affected by time in captivity, location of imprisonment and the current state of health or punishment.

The great variation in nutrient intake among prisoners held in the same location at the same time reflects the extreme disparity of treatment or the difficulty in obtaining accurate dietary histories with a long recall period. The variation in estimated daily energy intake among prisoners at two locations for two months, two years apart, is shown in Table 3. These variations are seen throughout all time periods and in all locations, and are reflected in the large standard deviation shown for all nutrients.

Those individuals held longest had greater opportunities for malnutrition than those in captivity for a short time. Therefore, nutrient intake is reported as it changed over time. As shown in Table 4, the length of captivity directly influenced the number of months at low

11. Watt, B.K. et al. USDA Handbook No. 8, 1963.

body weight. The chronic low weights would appear to be more detrimental to health and increase morbidity than the acute condition experienced by those persons held for a shorter time. The year a man was captured did not affect weight loss or his subsequent weight recovery. Many prisoners were nearer to "ideal" weight at repatriation than at time of capture because of high capture weights. However, "ideal" weight which results from refeeding of semistarved personnel is seldom ideal unless refeeding is accompanied by appropriate physical activity to insure that lean body weight represents the appropriate proportion of the regained weight. Regaining of weight without sufficient physical activity would result in a disproportionate increase in body fat.

In general, diets included three components - a staple, a soup, and a side dish.

The staple was the foundation of the diet of all prisoners; it accounted for more than two-thirds of energy and more than one-half of protein intake.

The type of staple significantly affected nutrient intake and varied according to the location of the prisoner. Rice was the staple used in the prisons in the South, while bread or a combination of bread and rice was served in the North Vietnam prisons. Table 5 indicates the relative frequency of each staple in diets in North and South Vietnam. The effect of the type of staple upon nutrient intake can be seen in Table 6. The nutrient content of bread is much greater than that of an equal amount of rice. There was little compensation for these differences in the amount served. The energy from rice in rice diets was only about two-thirds of value of energy from bread in the bread-based diets. Bread was usually baked in or near the prison. The repatriated POWs reported that it often contained hair, small stones, rat droppings, and other inedibles. The rice eaten was usually polished, although occasionally brown rice was substituted.

Soup was a significant source of vitamins A and C. It was an integral part of the daily fare in the North with 99 percent of the diets containing a soup. In the South, only 45 percent of the diets included soup. The soups were basically thin vegetable soups, occasionally containing pork fat. Bindweed (Calystegia soldanella), or rao mong, in Vietnamese, was the most commonly used plant for making soup. Other vegetables such as squash, pumpkin, pineapple, and Chinese cabbage were used in soup when available. The small quantity of pork fat in the soup often included skin with bristles intact. The consistency of the soup was usually dependent upon prevailing local conditions and food supplies. This was especially true in the South where mobility was important and the captors were at the end of supply chains.

The third major part of the diet was the "side dish" which in later years and under favorable conditions accompanied the staple and soup. These side dishes varied greatly between camps and over time.

Some items served as side dishes were dried and fresh fish, meat, assorted fruits and vegetables, and exotic items such as rats, elephant meat, and tree bark. These dishes were usually served with a fish sauce called nuoc mam.

During times of severe illness and after 1970, a sweetened milk was offered. Holiday meals consisted of turkey, salad, potatoes, and beer. Usually these holiday feasts were preceded by meals withheld and/or replaced the usual meal and, therefore, had no significant effect upon the long-term nutritional intakes of the men.

Average daily food consumption is shown in Figure 2. The data plotted in this and subsequent figures are mean values which are accompanied by fairly large standard deviations. The SD is the mean of the standard deviations about each of the twenty-five points along the respective line and is computed as the square root of the error mean square. The quantity of food consumed gradually increased until 1968 and changed only little afterward except for the refeeding accomplished immediately prior to repatriation. The low values for those held in the South prior to 1968, reflect the data of only one prisoner. After 1968, the average daily food consumption for those held in the North and the South was similar and was relatively stable. However, there continued to be great variation between individual prisoners depending upon their punishment or health status and their location.

The estimated energy intakes (Figure 2), based upon the dietary histories, appear unreconciled with the weight changes data shown in Table 4. A predicted energy consumption value was computed for each man (assuming an average energy expenditure of 36/kcal/kg body weight/day to maintain body weight). Figure 3 shows the distribution of the recalled or estimated to predicted energy intake ratios. The estimated energy values from the diet records averaged only 73 percent of the predicted values. Only 10 percent of the men had an estimated energy intake above their predicted value. There are inherent problems in the formula used to compute the data displayed in Figure 3 which should be considered in evaluating the figure and the data (See Appendix D).

In Figure 2 the average daily energy intake appears to be different for the two groups of prisoners. Those with rice staple diets were lower than the bread-eating group. The differences here reflect mostly the differences in the energy values between staples and the amount of pork contained in the soup or "side dish."

Only after 1969 did average protein intake in the South exceed 30 grams per day and many diets never reached this level. In the North the average protein intake were adequate after 1968 and were probably adequate for many prisoners after 1965. Adequacy would be dependent on the state of protein requirement of the individual prisoners. The presence of wounds or infection would increase the need for protein. An inadequate energy intake could convert an otherwise adequate protein intake into an inadequate one as protein was converted by the

body to provide calories. Hence during the period of continual weight loss the protein supply could be considered less than adequate with the degree of inadequacy compounded by the wounds and infections so many of the prisoners were reported to have suffered. Animal protein accounted for less than one fourth of the total protein intake in both the North and the South.

Fat intakes in the North and during the early period in the South were quite high in comparison to the normal South East Asian diet. Most of the fat consumed was animal fat, such as pork "fatback" found either in the soup or "side dish."

Calcium intakes (Figure 4) were much lower than the 800 mg per day National Research Council (NRC) recommended daily allowance. Values for prisoners in the South were especially low, at about 200 mg per day. However, it has been shown that men may adapt to these low levels if sufficient sunlight is available (12). The low protein intakes of the men imprisoned in the South would enhance the efficiency of calcium absorption (12) and increase their ability to maintain a positive calcium balance.

The phosphorus data in Figure 4 show the same patterns as the calcium with the calcium/phosphorus ratio remaining constant at 0.79 in the North and 0.52 in the South.

Iron intakes (Figure 4) were more than adequate in the North and just under the NRC allowance of 10 mg per day for adult males in the South.

The intakes of vitamin A and ascorbic acid (Figure 5) were directly related to the quantity of soup served. In the North, most diets contained a soup, and in the south about half of the diets had a soup. The most prevalent solids in these soups were bindweed, pumpkin, and various melons. These are all high in vitamin A and ascorbic acid, and were eaten in sufficient quantities to ensure adequate daily intakes providing overcooking was not practiced.

Thiamin, riboflavin, and niacin (Figure 5) appeared to differ between the North and the South after 1969, when the prisoners in the North received a third meal of bread and an extra side dish of meat or sweetened milk. The average intakes for the South are near the level where deficiency symptoms may appear. However, the low energy intakes reported for this group tend to depress the thiamin requirement (12). Symptoms of thiamin deficiency manifested as beriberi were described by some prisoners held in the South (13), which agree with these data.

12. National Research Council, Recommended Dietary Allowances, 1974.
13. Berg, S.W. In: Family Separation and Reunion, 1975. Chapter 8.

Vitamin supplementation was not included in the values presented in Figure 5. Almost two-thirds of the men held in the North received vitamin pills as compared to only one-third of those in the South. Figure 6 shows the percent of men (both groups combined) receiving some vitamin supplementation. Commencing in 1969, the "care" packages sent by families of the prisoners, which included vitamin pills, were received in significant numbers. Generally supplies were pooled and then redistributed among the men. The exact effect of vitamin supplementation is difficult to assess because of the variety of pills received and the inability of most prisoners to recall the type and frequency of pills consumed.

CONCLUSIONS

The conclusions drawn for this study can only be general in nature. The long captivity period and the pace of Operation Homecoming make an accurate and comprehensive dietary recall extremely difficult. The great diversity of conditions, dietary intake, the number of individuals further complicate the description of "a" captivity diet and nutrient intake.

These data do show that generally the prisoners held in North Vietnam prisons were better nourished than their counterparts in the South. The Northern prisoners were held in larger groups with reasonable food preparation facilities and near the sources of food supplies of North Vietnam. The Southern prisoners were in the war zone where mobility was crucial. They were also at the end of a supply chain where deprivation was more easily effected.

The data presented show only mean values and describes nutrient intakes which are low but not severe except for energy. However, these mean values should not hide the individuals who did suffer extreme deprivation and malnutrition. Even though many individuals in later years (1968 +) received near adequate nutrition, there were some who were deprived and wasted. We have data for only those fortunate enough to survive the ordeal.

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APPENDIX A

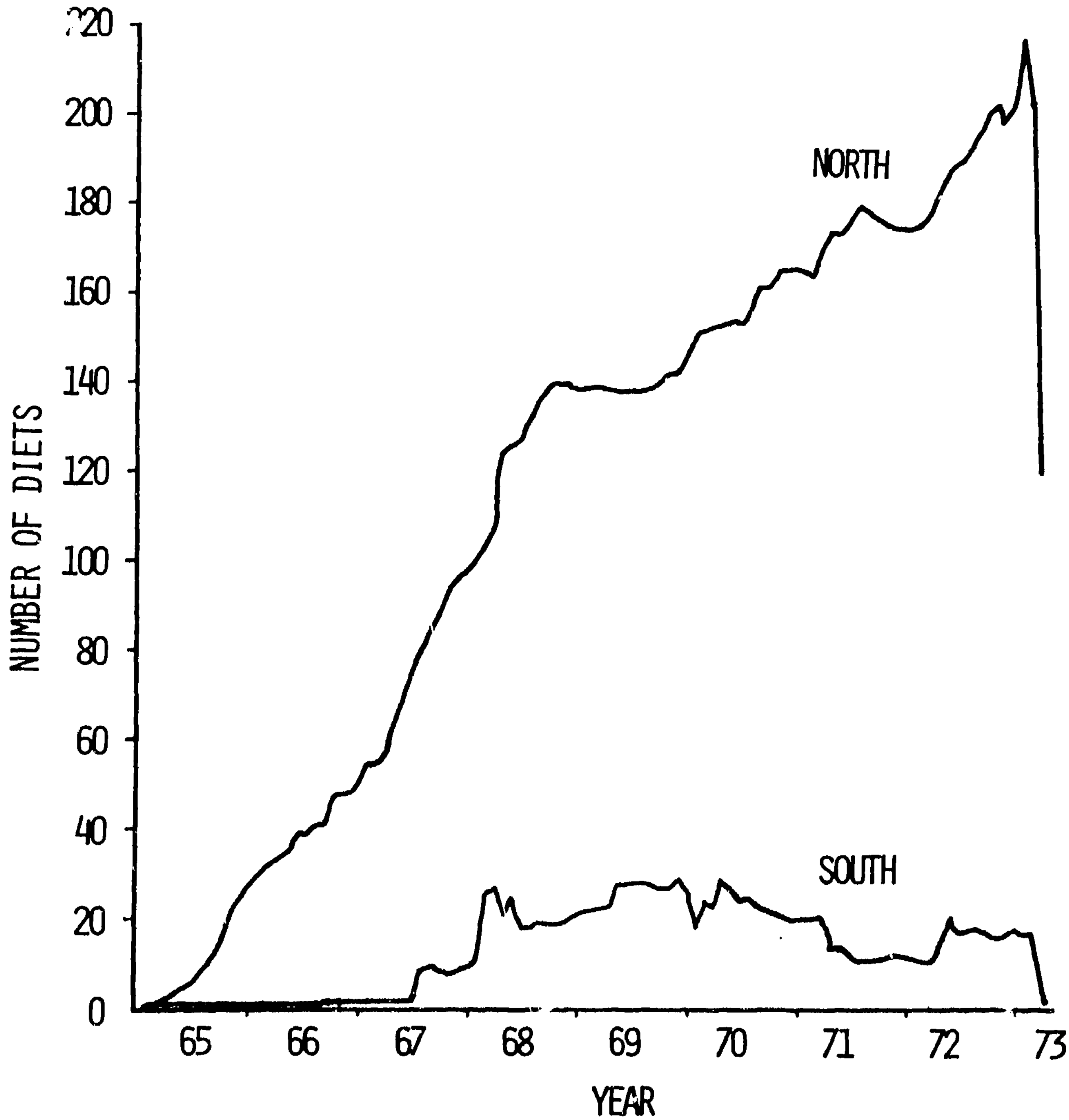
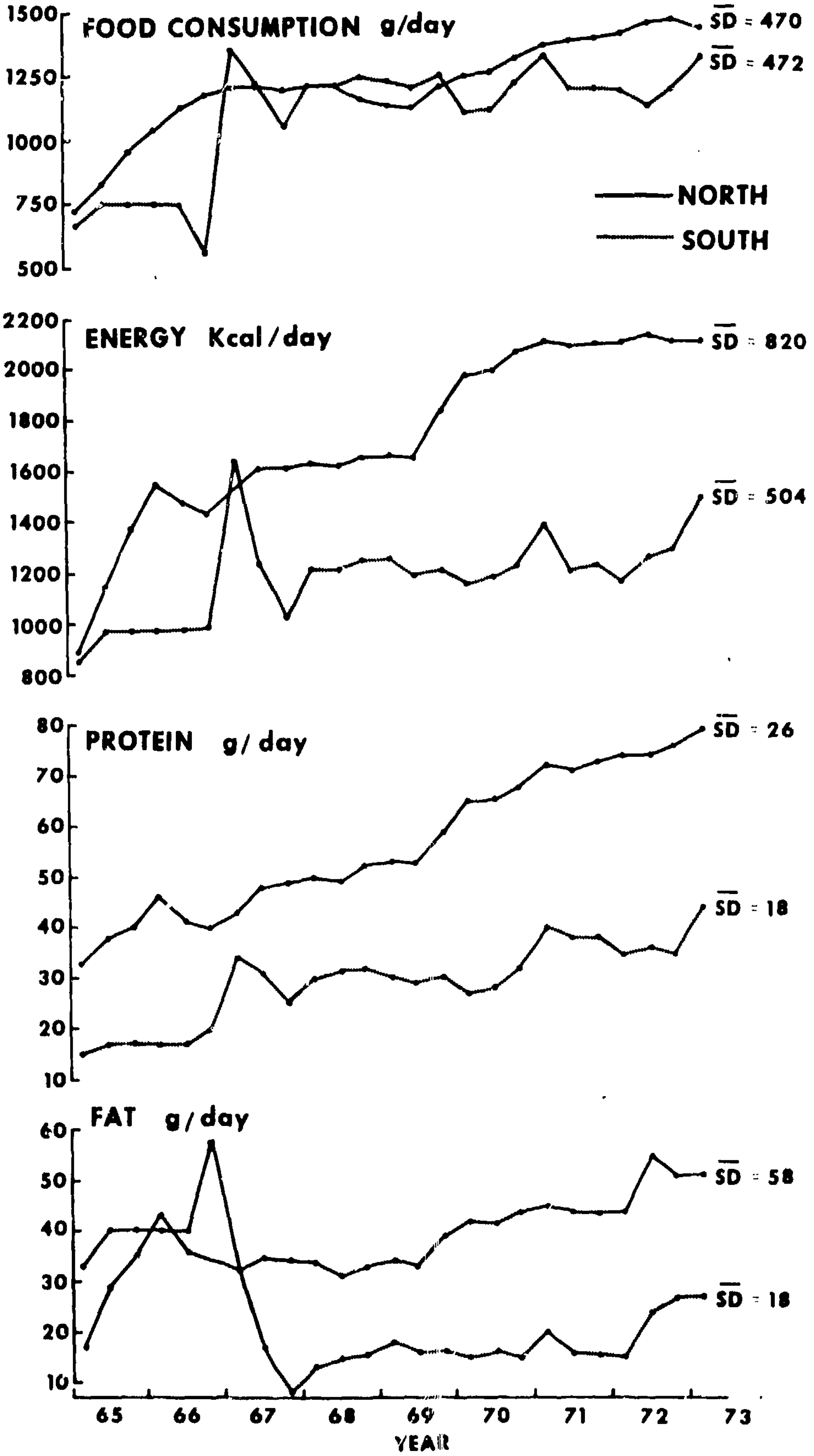


Figure 1. Number of diets by month of prisoners held captive in the North and South


FOOD CONSUMPTION g/day
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1250
1000
750
500
SD = 470
SD = 472
NORTH
SOUTH
ENERGY Kcal/day
2200
2000
1800
1600
1400
1200
1000
800
SD = 820
SD = 504
PROTEIN g/day
80
70
60
50
40
30
20
10
SD = 26
SD = 18
FAT g/day
60
50
40
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SD = 18
65
66
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YEAR

Figure 2.

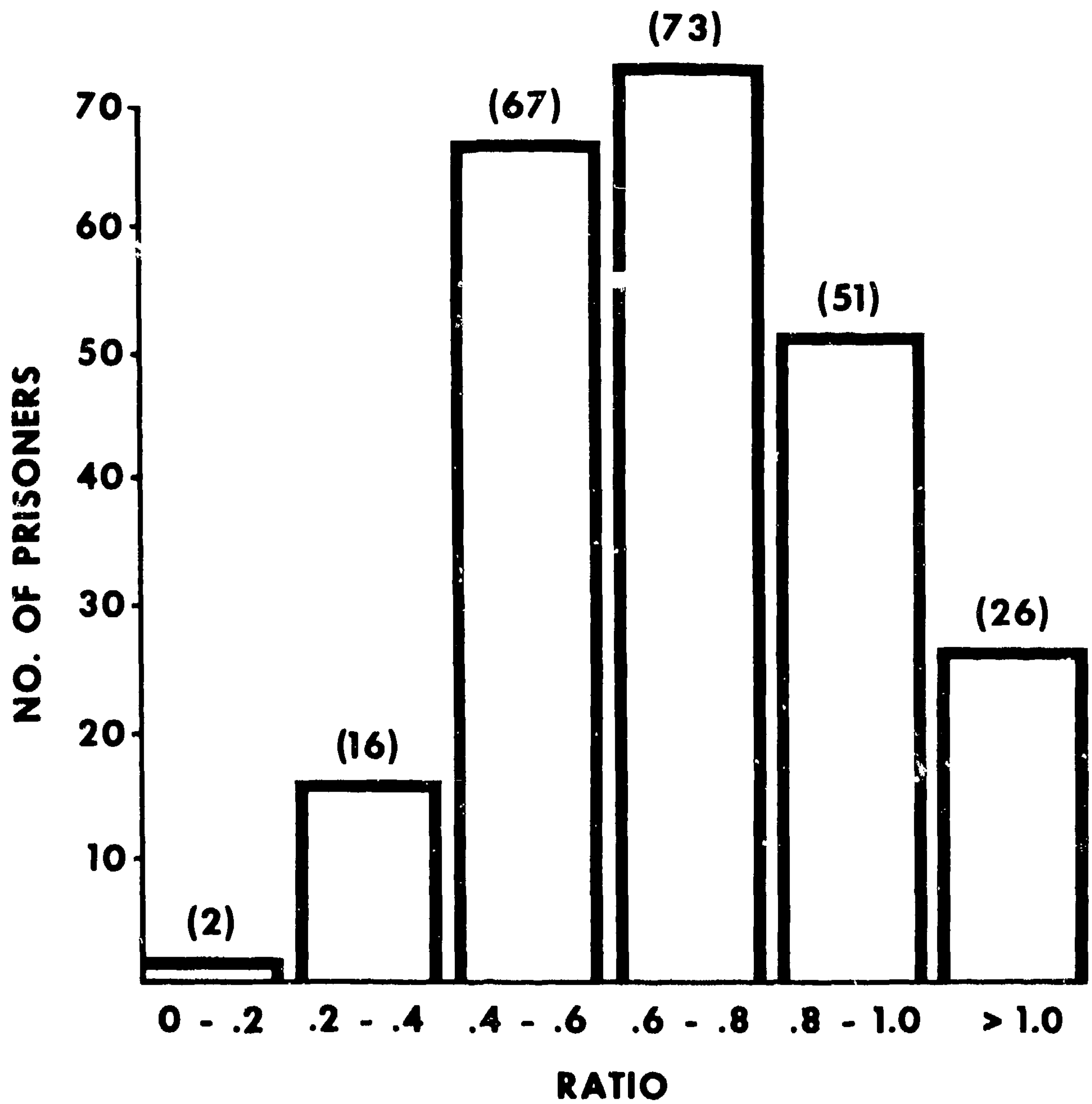
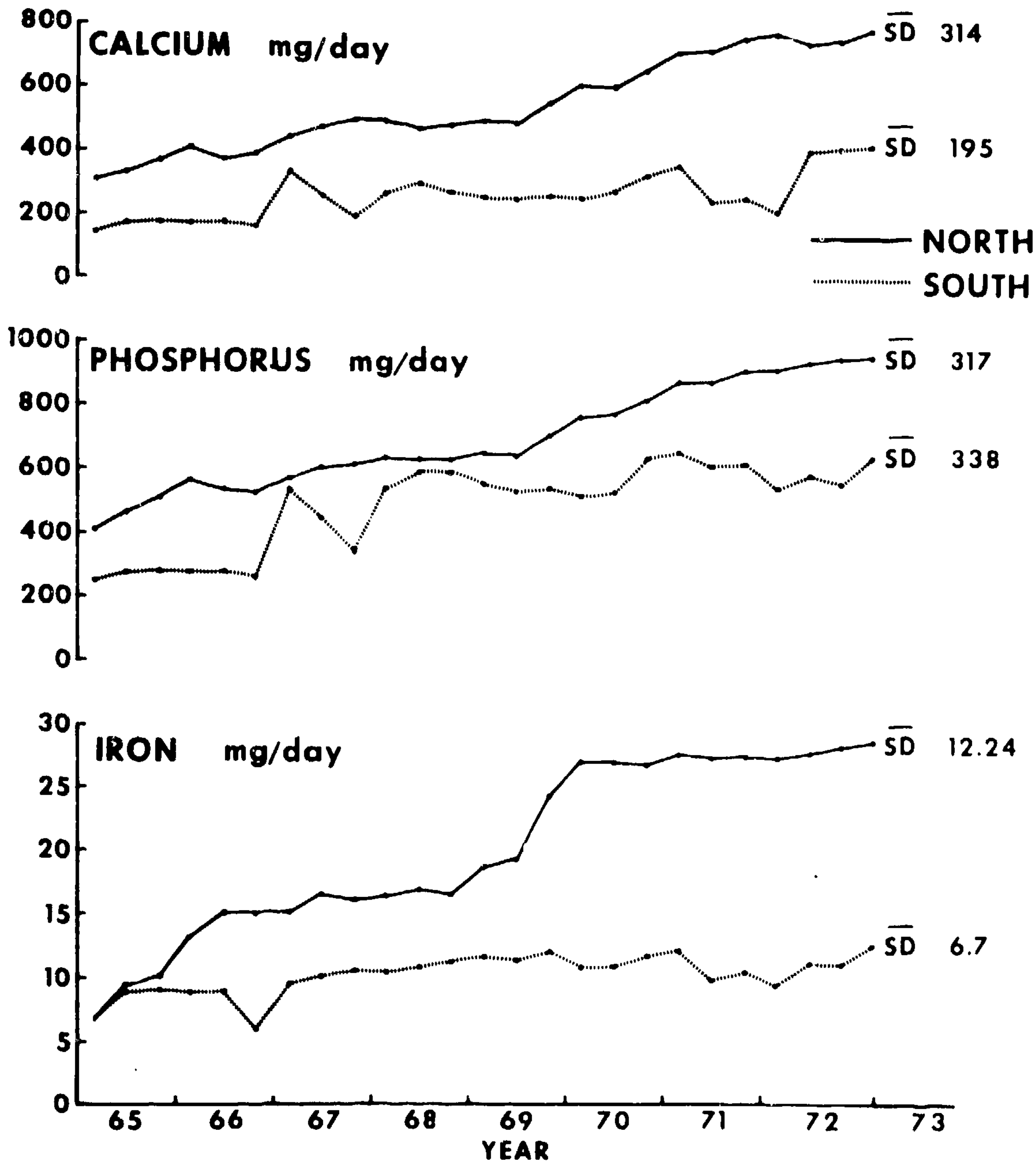
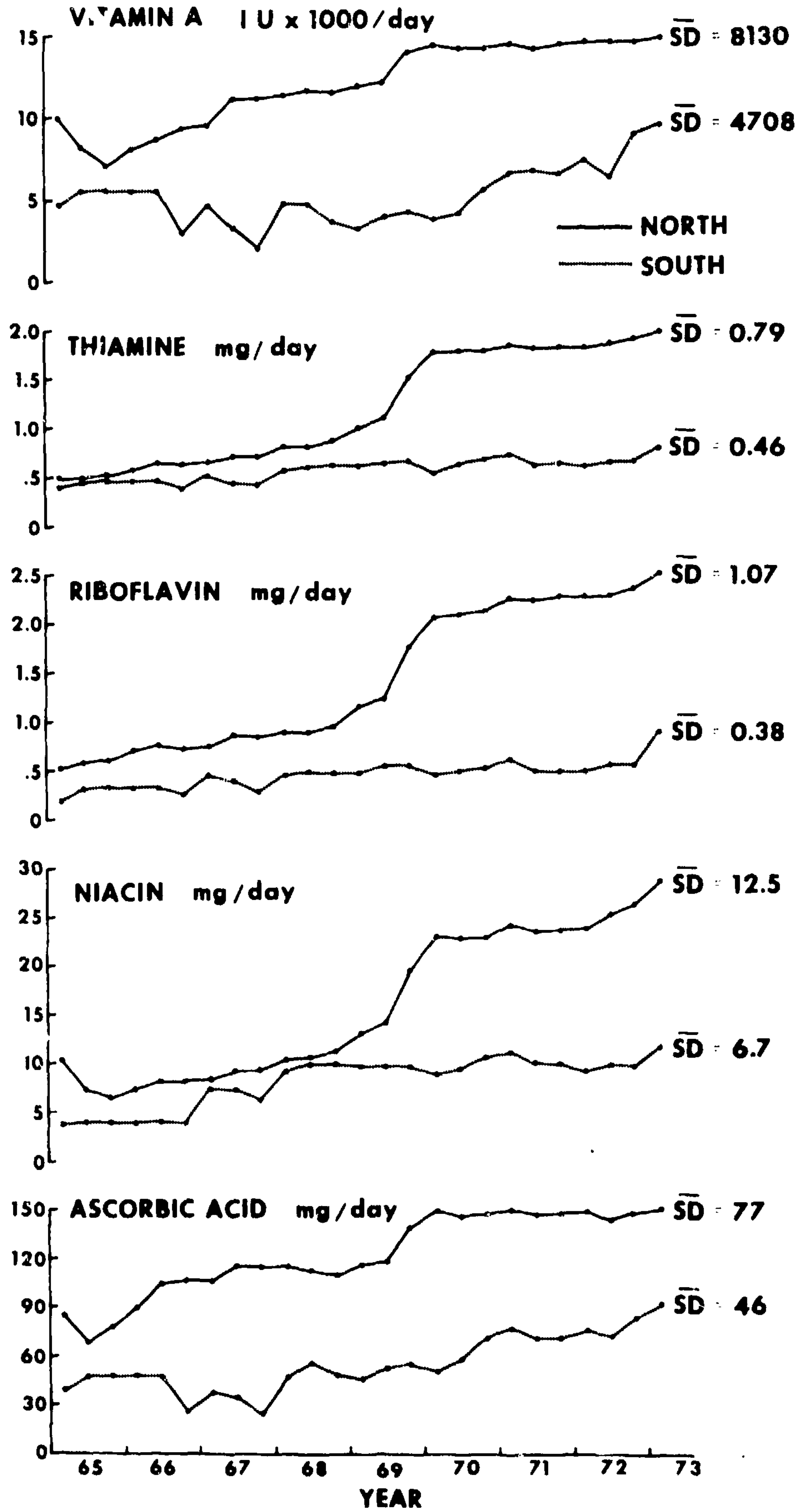


Figure 3. Frequency distribution of prisoners at each recalled energy intake/predicted energy intake ratio.



CALCIUM mg/day
800
600
400
200
0
SD 314
SD 195
NORTH
SOUTH
PHOSPHORUS mg/day
1000
800
600
400
200
0
SD 317
SD 338
IRON mg/day
30
25
20
15
10
5
0
SD 12.24
SD 6.7
65
66
67
68
69
70
71
72
73
YEAR

Figure 4.


V.'AMIN A I U x 1000/day
SD = 8130
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NORTH
SOUTH
THIAMINE mg/day
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SD = 1.07
SD = 0.38
NIACIN mg/day
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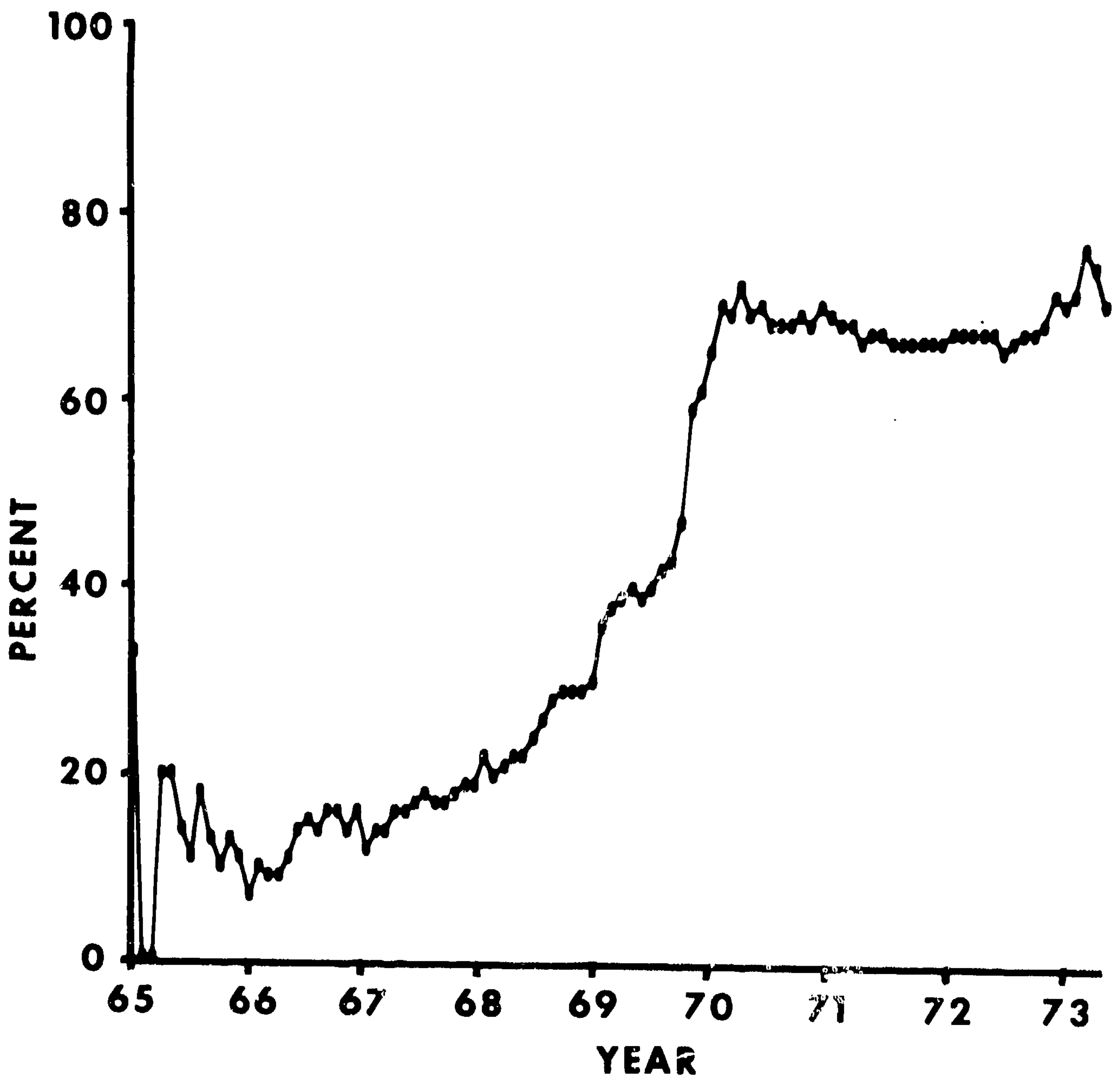
SD = 6.7
ASCORBIC ACID mg/day
SD = 77
SD = 46
65 66 67 68 69 70 71 72 73
YEAR

Figure 5.



PERCENT OF DIETS WITH VITAMIN SUPPLEMENTS

Figure 6.

A P P E N D I X B

TABLE 1

CONUS Hospitals Participating in Operation Homecoming

	No. of Repatriates Assigned	
ARMY:		
Brooke Army Medical Center, Ft. Sam Houston, TX	12	
Letterman Army Medical Center, Presidio of San Francisco, CA	9	
Fitzsimons Army Medical Center, Denver, CO	14	
Valley Forge General Hospital, Phoenixville, PA	16	
Tripler Army Medical Center, Honolulu, HI	3	
Ireland Army Hospital, Ft. Knox, KY	7	
Patterson Army Hospital, Ft. Monmouth, NJ	4	
U.S. Army Medical Center, Ft. Gordon, GA	12	
TOTAL ARMY		77
NAVY:		
Oak Knoll Naval Hospital, Oakland, CA	25	
Balboa Naval Hospital, San Diego, CA	43	
U.S. Naval Hospital, Great Lakes, IL	9	
U.S. Naval Hospital Philadelphia, PA	3	
U.S. Naval Hospita Bethesda, MD	9	
U.S. Naval Hospital, Portsmouth, VA	12	
St. Albans Naval Hospital, NY	13	
Chelsea Naval Hospital, Boston, MA	4	
U.S. Naval Hospital, Jacksonville, FL	26	
U.S. Naval Hospital, Bremerton, WA	3	
U.S. Naval Hospital, Memphis, TN	6	
U.S. Naval Hospital, Camp Lejeune, NC	2	
U.S. Naval Hospital, Camp Pendleton, CA	9	
TOTAL NAVY		164
TOTAL REPATRIATES (ARMY AND NAVY)		241

TABLE 2

Standard Weights Used for Repatriate Nutrient Intake Calculations

COMMON DIET ITEMS	GRAMS
Bread	
12 Inch Loaf	= 200
10 Inch Loaf	= 160
8 Inch Loaf	= 120
Rice, 1 Cup	= 150
Soup	
Vegetable, 1 Cup	= 100 Solids
Thick, 1 Cup	= 150 Solids
Thin, 1 Cup	= 70 Solids
SIDE DISHES	
Green Beans, 1 Cup	= 125
White Beans, 1 Cup	= 200
Chinese Cabbage, 1 Cup	= 170
Collards, 1 Cup	= 200
Eggplant, 1 Cup	= 200
Kohlrabi, 1 cup	= 200
Green Pepper, 1 Large	= 100
Potato, 1 Medium	= 100
Pumpkin, 1 Cup	= 200
Spinach, 1 Cup	= 180
Sweet Potato, 1 Cup	= 180
Gourd, 1 Cup	= 200

OTHER	GRAMS
Sugar, 1/2 Cup	= 100
Powdered Milk, 1 Cup	= 246
Peanuts, 20-22 nuts	= 20
Banana, Green	= 50
Orange	= 120
Chocolate Bar	= 30
1 Egg, Chicken	= 50
1 Egg, Duck	= 74
Pork Fat, 1" x 2" x 4"	= 30
Pork Meat, 3" x 2-1/4" x 3/8"	= 40
Beef, 3-1/2" x 2" x 3/8"	= 100
Chicken & Turkey, 1" x 2-1/2" x 1/4"	= 10
Beverages, 1 cup	= 224

GENERAL

1 oz	= 28 Grams
1 lb	= 454 Grams
1 liter	= 1 Qt = 2 Pt = 32 oz
3 teaspoons	= 1 Tablespoon = 15 Grams
4 tablespoons	= 1/4 Cup
2 Cups	= 1 Pint

TABLE 3. Variation in Total Energy Intake (Kcal/Day) of Prisoners in Two Randomly Selected Locations at Two Months

	Location A (Oct 1970)	Location B (Oct 1972)
Number of Men	39	61
Mean (Kcal/Day)	1471	2029
S.D. (Kcal/Day)	624	735
Minimum (Kcal/Day)	416	587
Maximum (Kcal/Day)	3775	4563
C.V. (Percent)	42	36

TABLE 4. Summary of Body Weight Changes as Affected by Length of Time in Captivity

Year Captured	No. of Men	% of Body* Wt Lost	No. Months at Low Wt	% Body** Wt Regained	Repatriated Wt*** / Capture Wt X 100
1965	22	25.8	14	14.3	69.1
1966	24	21.4	15	10.0	88.6
1967	58	20.8	14	10.9	90.7
1968	49	25.1	10	15.2	90.6
1969	10	29.3	7	17.9	88.8
1970	11	28.3	7	12.6	84.3
1971	7	21.0	6	5.8	84.8
1972	25	18.0	3	6.2	88.7

* % of Body wt. lost = $\frac{\text{low wt.}}{\text{capture wt.}}$ X 100

** % of Body wt. regained = $\frac{\text{repatriated wt. - low wt.}}{\text{capture wt.}}$ X 100

*** % of Capture wt. at repatriation = $\frac{\text{repatriated wt.}}{\text{capture wt.}}$ X 100

TABLE 5. Source of the Staple in Prisoner-of-War Diets in North and South Vietnam

Staple	North	South
	Percent of Diets With	
Bread only	30	2
Rice only	8	91
Bread and Rice	62	7

TABLE 6. Comparison of Selected Nutrients of French Style Bread Made with Unenriched Wheat Flour and of Cooked White Milled Rice

	Nutrient per 100 gm					
ITEM	Energy (Kcal)	Protein (gm)	Iron (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)
Bread	290	9.1	0.7	0.08	0.08	0.08
Rice	109	2.0	0.2	0.02	0.01	0.4

TABLE 7. Estimates of Total Energy Requirement Based on Dietary Recall and Weight Change

Subject	Recalled Intake, kcal	Deficit Energy, kcal	Total	Ave. Wgt. Estimated	kcal/kg/day
1	2,992,052	133,000	3,125,052	60Kg	28.84
2	4,784,863	52,500	4,837,363	65	40.91
3	3,222,261	14,000	3,237,261	62	27.78
4	3,033,755	80,500	3,114,255	70	24.05
5	1,745,749	147,000	1,892,749	75	13.61
6	846,620	59,500	906,120	66	11.14

TABLE 8. Predicted energy intake calculated based on two average weights during captivity estimated by independent investigators.

	Predicted Energy Intake kcal	Deficit kcal	Total kcal	Weight kg	Est. Required kcal/kg/day
1	a. 4,501,182	133,000	4,634,182	69.23	37.06
	b. 3,900,960	133,000	4,033,960	60.00	37.23
2	a. 4,360,773	52,500	4,413,273	66.60	36.43
	b. 4,256,460	52,500	4,308,960	65.00	36.44
3	a. 4,238,255	14,000	4,252,255	62.60	36.13
	b. 4,196.160	14,000	4,210,160	62.00	36.12
4	a. 5,074,045	80,500	5,154,545	76.19	36.57
	b. 4,662,000	80,500	4,742,500	70.00	36.62
5	a. 5,478,818	147,000	5,625,818	82.00	37.00
	b. 5,005,800	147,000	5,152,800	75.00	37.06
6	a. 3,003,773	59,500	3,063,273	67.67	36.71
	b. 2,929,608	59,500	2,989,108	66.00	36.73

a. Estimated average body weight for duration of captivity by observer 1 and resultant calculated figures.

b. Estimated average body weight for duration of captivity by observer 2 and resultant calculated figures.

TABLE 9.

Ratio Recalculated Based on Energy Requirement of 25 kcal/kg/day

		Est. Ave. Weight	Predicted Energy kcal	Deficit kcal	Total kcal	kcal/kg/day	Ratio calculated using 36 kcal/kg	Ratio calculated using 25 kcal/kg
1	a.	69.23	3,125,734	133,000	3,258,734	26.06	.6647	.9572
	b.	60.0	2,709.000	" "	2,842,000	26.23	.7670	1.1045
2	a.	66.6	3,028,635	52,500	3,081,135	25.43	1.0972	1.5799
	b.	65.0	2,955,875	" "	3,008,375	25.44	1.1241	1.6188
3	a.	62.6	2,942,200	14,000	2,956,200	25.12	.7603	1.0952
	b.	62.0	2,914,000	" "	2,928,000	25.12	.7679	1.1058
4	a.	76.19	3,523,788	80,500	3,606,288	25.58	.5979	.8609
	b.	70.00	3,237,500	" "	3,318,000	25.62	.6507	.9371
5	a.	82.00	3,800,700	147,000	3,947,700	25.97	.3186	.4593
	b.	75.00	3,476,250	" "	3,623,250	26.06	.3487	.5022
6	a.	67.67	2,085,928	59,500	2,145,428	25.71	.2818	.4059
	b.	66.00	2,034,450	" "	2,093,950	25.73	.2890	.4161

a. Estimated average body weight for duration of captivity by observer 1 and resultant calculated figures.

b. Estimated average body weight for duration of captivity by observer 2 and resultant calculated figures.

GLOSSARY

Vietnam Harvest Calendar

Seasons in Vietnam

Names of Vietnamese Plants and Food (Vietnamese, Scientific, English names)

APPENDIX C

APPENDIX C

VIETNAM HARVEST CALENDAR

CROPS	HARVEST PERIOD	BULK OF HARVEST
Rice:		
Centre	Apr - Nov	Apr - May
South	Sep - Mar	Jan - Feb
Sugar Cane	Oct - May	Jan - Apr
Sweet Potatoes	Aug - Nov	Oct - Nov
Cassava	Aug - Dec	Oct - Nov
Vegetables	Whole Year Round	Dec - Feb
Cowpeas	Nov - Feb	Dec - Jan
Citrus Fruits	Aug - Feb	Dec - Jan
Bananas	Whole Year Round	Nov - Jan
Mangoes	Apr - Jul	May - Jun
Pineapples	Whole Year Round	Jun - Aug
Soybeans	Jul - Jan	Oct - Nov
Coconuts	Whole Year Round	Dec - Apr
Castor Beans	Oct - Feb	Dec - Jan
Tobacco	Dec - Apr	Feb - Mar
Coffee	Nov - Mar	Dec - Feb
Tea	Whole Year Round	Sep - Oct
Cotton	Feb - May	Mar - Apr
Jute	Jul - Nov	Oct - Nov
Ramie	May - Nov	Jul - Aug
Kapok	Feb - Apr	Mar - Apr
Rubber	Whole Year Round	Oct - Dec

SOURCE: Food and Agriculture Administration: World Crop Harvest Calendar, Rome, 1959.

SEASONS IN VIETNAM

NORTH

Winter monsoon - Mid-September-April
Summer monsoon - Mid-May - Mid-September

SOUTH

Winter monsoon - Early October - Early May
Summer monsoon - May-September

APPENDIX C

Names of Vietnamese Plants and Food

Vietnamese	Scientific	English
Cai sa-lat	Lactuca scariola	Lettuce
Cai xanh	Brassica oleracea acephala	Cole, kale
cai bap	Brassica oleracea Linn.	Cabbage
Ca to mat	Solanum lycopersicum Linn.	Tomato
Dua leo xanh	Cucumis sativus Linn.	Gherkin
Dua gang	Cucumis melo Linn.	Melon
Dua hau	Citrullus vulgaris Schrad	Watermelon
Thom (dua)	Ananassa staiva Lindl.	Pineapple
Hanh	Allium cepa Linn.	Onion
He	Allium angulosum Linn.	Mouse garlic
Rau rap	Houttuynia cordata Thunb	Leafy plant
Rau can	Apium graviolens Linn.	Celery
Rau can tau	Brassica chinensis	Chinese cabbage
Rau can nuoc	Oenanthe stolonifera Wall	Water celery
Rau rut (rhut)	Neptunia oleracea Linn.	Water plant
Rau den	Amaran tus gangeticus Linn.	Leafy vegetable
Rau mung toi	Basella rubra Linn.	(eaten like spinach)
Trai dau bap	Hibiscus esculentus Linn.	Okra
Muop ngot	Luffa cylindrica Roem	Sweet cucumber
Muop dang	Momordica charantia Linn.	Bitter cucumber
Muop khia	Luffa acutangula Roxb	Strainer vine cucumber
Bau ngan	Aegle marmelos Correa	Bengal quince (short variety)
Bau dai	Aegle marmelos Correa	Bengal quince (long variety)
Bi dao	Benincasa hispida Cogn	A variety of gourd or squash
Bi xanh	Benincasa hispida Cogn	A variety of gourd or squash
Bi do	Cucurbita maxima Duch	Turban squash
Can nau	Solanum melongena Linn.	Aubergine, egg-plant
Dau phung	Arachis hypogea Linn.	Peanut
Khoai mi (san)	Manihot utilissima Pohl	Manioc
Khoai mon	Colocasia esculentum Schott	Taro
Khoai mo	Dioscorea alata Linn.	White yam
Khoai tu	Dioscorea esculenta Lour	Yam
Khoai tay	Solanum tuberosum Linn.	Irish potato
Khoai lang	Ipomoea batatas Lamk	Sweet potato
Xu hao	Brassica oleracea caulo-rapa	Turnip Cabbage
Xu xu	Sechium edule Sw.	Chayote
Dau haricot ve (dau que)	Phaseolus vulgaris Linn.	Green beans
Dau haricot trang	Dolichos catjang Linn.	White french beans
Dau haricot ve (dau mong chim)	Phaseolus lutanus Linn.	Sieva bean

Names of Vietnamese Plants and Food (Cont'd)

Vietnamese	Scientific	English
Rau muong	Ipomoea aquatica Forsk	Water convolvulus
Rau hung	Mentha aquatica Linn.	Mint
Rau que or hung cho	Ocimum basilicum Linn.	Sweet basil
Rau dam	Polygonum odoratum Lour	A variety of thyme
Riz	Oryza staiva Linn.	Rice
Lua mi	Triticum spelta Linn.	Wheat
Lua mach nha	Hordeum distichon Linn.	Barley
Bap	Zea mays Linn.	Corn
Ke	Panicum miliaceum Linn.	Millet
Lua Mien	Sorghum vulgare Pers.	Sorghum
Sagou	Zamia integrifolia Ait.	Sago
Dua Hoa lan	Pisum sativum Linn.	Green peas
Lentilles	Lens esculenta Moench	Lentils
Hot sen	Nelumbium speciosum Willd.	Lotus
Ngo sen	Nelumbium luteum Willd.	Lotus
Dau manh	Glycine soja Sieb & Zucc.	Soyabean
Dua	Cocos nucifera Linn.	Coconut
Dua	Cocos nucifera Linn.	Coconut tree
Me	Sesamum indicum Linn.	Sesame
Dau dau	Elaeis guineesis Jacq.	Red palm oil
Rau den tia	Amaranthus species	Pigweed
Rau cuc tan	Cardamine species	Water cress
Rau tay	Spinacia oleracea Linn.	Spinach
Rau mong	Calystegia soldanella	Bindweed
Cai be trang	Brassica alba Boiss	Mustard leaf
Dot lang	Solanum tuberosum Linn.	Potato leaves
Rau mui	Coriandrum sativum Linn.	Coriander
Artichaut	Cynara cardulculus Linn.	Artichoke
Mang Tay	Asparagus officinalis Linn.	Asparagus
Mang Tre	Bambusa	Bamboo shoots
Mia	Saccharum officinarum Linn.	Sugar cane
Choux	Brassica	Brussel sprouts
Chuoi	Musa	Banana tree
Bap chuoi	Musa species	Banana flowers
Hoa hien	Cucurbita pepo Linn.	Pumpkin
Cu toi	Allium sativum Linn.	Garlic
Cu den do	Daucus carota Linn.	Carrot
Cu he	Allium ascalonicum Linn.	Small onion (shallot)
Toi tay	Allium ampelo prasum Linn.	Leeks
Cu cai do	Ranunculus sativus Linn.	Radish
Buoi	Citrus grandis Osbeck	Grapefruit tree, Pomelo tree
Cam	Citrus species	Orange tree
Quyt	Citrus nobilis Lour	Tangerine tree
Oi	Psidium guyava Linn.	Guava tree
Chanh	Citrus species	Lemon tree
Mit	Artocarpus integrifolia Linn.	Jack tree
Soai	Mangifera species	Mango

Names of Vietnamese Plants and Food (Cont'd)

Vietnamese	Scientific	English
Vu sua	Chrysophyllum cainito Linn.	Milk or star apple
Man cau (na)	Annona squamosa Linn.	Anona or Custard apple
Long nhan	Nephelium longana	Longan tree
Khe	Averrhoa carambola Linn.	Carambole fruit
Me	Tamarindus indica Linn.	Tamarind fruit
Tam duoc	Phyllanthus distichus Muell	Gooseberry
Dao	Eugenia jambos Linn.	Roseapple
Man (roi)	Prunus triflora Roxb	Japanese plum
Du du	Carica papaya Linn.	Papaya tree (Papaw tree)
La ki ma	Lucuma Mammosa Gaerth	Mamey sapodilla Mamey sapote
Dau	Baccaurea sapida Muell-Arg.	Fruit
Cau	Areca catechu Linn.	Arec or Betal nut tree
Trau	Piper betle Linn.	Leaves chewed with Betal
Cu cai trang	Ranunculus sativus Linn.	White radish
Abricot	Prunus armeniaca Linn.	Apricot
Chanh giay	Citrus medica Linn.	Citron
Gie gai	Trapa natans Linn.	Chestnut
Sau rieng	Durio Zibethinus Murr.	Durian
Dau tay	Fragavia	Strawberry
Mit trai	Treculia africana Decne	Breadfruit
Quit	Citrus	Mandarin
Mang cut	Diospyros discolor Willd	Mangosteen
Man	Prunus domestica Linn.	Prune
Sa bo che	Achras sapota Linn.	Sapote
Thit bo		Beef
Trau		Buffalo
Vit		Duck
Tho		Rabbit
Truu (thit bap)		Mutton
Thit heo nac		Pork
Thit mo		Fat pork
Ga		Chicken
Gan bo can		Veal
Nhong tam		Silk worm
Tom		Shrimp
Cua Thit		Crab
Oc Nhoi		Snail
Ca tuoi		Fish
Ca kho		Dried fish
Muc tuoi		Cuttle fish
Trung ga		Hen's egg
Trung vit		Duck's egg
Sau bo tuoi		Cow's milk
Sua da		Goat's milk
Bo		Butter
Mo bo		Beef fat
Mo heo mo nuoc		Lard

Problems Inherent in Deriving Data Contained in Figure 3

APPENDIX D

APPENDIX D

Problems Inherent in Deriving Data Contained in Figure 3

The formula used to calculate the ratios utilized in Figure 3 was:

Calculated energy intake during captivity based on recall/predicted energy requirement during captivity.

The accuracy of the dividend in this formula is based on: the ability of the repatriate to recall the details of dietary intake through months and years of captivity; the skill of the interviewer to stimulate memory and to properly translate the recalled information; and the accuracy of the nutrient factor file.

The divisor is based upon an estimate of the average caloric expenditures per kilogram of body weight of 241 repatriates through up to 9 years imprisonment. It requires an estimate of the average body weight of each individual throughout the period of captivity. Also required is knowledge of the duration of captivity. The one item that can be considered a fact and which is common to both the dividend and the divisor is the duration of captivity for each individual.

The problems involved in projecting a weight which would properly represent an average weight for each individual throughout the entire period of imprisonment without frequent accurate weights were enormous and resulted in educated guesses. The projection of an average energy expenditure expressed as kcal/kg/day for each individual is also fraught with many problems but to project a figure to represent the average for the entire group is even more difficult. The major energy expenditure for sedentary or even moderately active individuals would be that for sustaining the basal metabolic rate. In normal young adult males the basal metabolic rate ranges from approximately 22.5 to 28.0 kcal/kg/day dependent upon height, weight and decade of adult life. Starvation or semistarvation causes a sharp drop in the basal metabolic rate until a plateau is reached. During semistarvation this plateau then continues until an adequate intake of energy is received at which time the basal metabolic rate returns towards the normal for the new weight established. Additional energy expenditure is dependent upon the hours spent sleeping (decreases), physical activity (increases), emotional stress (generally increases), presence of wounds (increases), presence of infection (increases) and the environmental temperature. Consolazio et al, Viterie et al and others have also shown that an inadequate diet or an unbalanced diet increases the energy cost to do the same work as compared to the energy cost when the same individuals were receiving a properly balanced nutrient intake sufficient to correct the preexisting deficiencies.

To evaluate the accuracy of the dietary recalls, two approaches could be taken - both requiring a projection of the individuals average weight throughout the period of captivity. The first approach is that used in deriving Figure 3. In the second, one could assume that the dietary history was correct. Considering that, of the 241 men evaluated in this report, 227 of them lost weight during captivity (capture weight minus repatriation weight) and that weight loss or gain has a caloric equivalent, the caloric equivalent (3,500 kcal/pound: 7,700 kcal/kg) of that weight change could be added to the recalled energy intake to determine the total energy expenditure. This figure could then be converted to kilocalories/kilogram/day and the later evaluated in terms of known physiological needs of the individual.

To evaluate both approaches, data from 6 Army repatriated personnel were randomly selected for comparison. In Table 7 the data for these six individuals are compared. The total energy requirement has been derived and that converted into kcal/kg/day. The range of from 11.14 to 40.91 kcal/kg/day appears excessive. Based on the limited history available the low rate of energy requirement for subjects 5 and 6 appears incompatible with the physiological requirements of these individuals over the long duration of their captivity suggesting that the recalled energy intake was low. Little can be said of the accuracy of the recalled energy intake history of the other four. Because of the apparent inaccuracy of the recalled energy intake histories, it is obvious that the second approach can not be used.

Figure 3 is based upon the calculated ratio of recalled energy intake divided by the predicted intake. The predicted intake was based on 36 kcal/kg/day times an estimated average weight for each repatriate during his entire period of captivity. Based on the limited data available, two investigators independently estimated the average weights for these six individuals. Table 8 presents the impact of the difference of the average weights estimated by the two investigators upon the predicted energy intake. The predicted average intake used to derive Figure 3 did not consider the caloric equivalent of the body weight change - capture weight minus repatriation weight. That has been considered in calculating the "required kcal/kg/day" given in the right hand column of Table 8.

It can be seen in Table 8 that by starting with a fixed predicted energy expenditure/unit of body weight that the estimated energy requirement for body weight for all individuals will, of necessity, be relatively fixed. The use of a fixed requirement in the prediction equation also dictates the value of the ratio obtained from the formula: recalled intake/predicted intake. This is illustrated in Table 9 where 25 kcal/kg/day was used to derive the predicted energy intake. Two reasons for using 25 kcal/kg/day were: a. This figure should be close to the average energy requirement for the basal metabolic rate had the prisoners maintained body weight throughout captivity but due to the long period of energy deprivation 25 kcal/kg/day should have been above actual basal metabolic needs; b. To be sufficient to emphasize the

impact of the resultant derived ratios on Figure 3. It can be seen that by change in estimated average weight that for one individual the ratio is sufficiently changed to shift the figure to the right. By changing the predicted requirement from 36 kcal/kg/day to 25 kcal/kg/day the whole graph would be shifted to the right.

As currently depicted Figure 3 does emphasize the problem in trying to determine dietary intake based upon dietary recall utilizing multiple interviewers interviewing individuals of divergent backgrounds to recall distant dietary patterns. In retrospect, it would be impossible to establish a scientifically valid average predicted requirement and it now becomes a point of hypothetical discussion as to whether 30, 33, 36 or 40 kcal/kg/day was the appropriate energy requirement to use to predict intake. At least one of the coauthors feels that the requirement was probably lower than 36 kcal/kg/day and hence the curve in Figure 3 should be skewed more to the right but that supposition shall remain unproven.

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